IAS-TUM Workshop
Recent progress on tensor network methods

April 22-25, 2024
Institute for Advanced Study, Technische Universität München

Monday, 22 April, 2024

09:05	*Welcoming words by the hosts*
09:15-09:55	**Ulrich Schollwoeck** (LMU): Tensor networks for real materials
10:05-10:45	**Henrik Larsson** (UC Merced): Tensor network states for computing vibrational and electronic states
10:55-11:20	*Coffee break*
11:20-12:00	**Thomas Barthel** (Duke): Variational quantum algorithm for quantum matter using Trotterized entanglement renormalization
12:10-12:30	**Dian Wu** (EPFL): Variational Benchmarks for Quantum Many-Body Problems
12:35-14:10	*Lunch break*
14:15-14:55	**Mari-Carmen Bañuls** (MPI Quantum Optics): Algorithms for non-equilibrium dynamics in 1D systems
15:05-15:45	**Norbert Schuch** (University of Vienna): Tensor networks and the negative sign problem
15:55-16:20	*Coffee break*
16:20-16:40	**Miklós Antal Werner** (Wigner Research Centre for Physics, Budapest): Efficient simulation of two dimensional quantum lattice models by a mode optimized hybrid CPU-GPU density matrix renormalization group method
16:45-17:05	**Julian Rincon** (Los Andes): Luttinger/Fermi mixing in one-dimensional quantum fluids: A tensor-network study
17:10-17:30	**Yaling Ke** (ETH Zurich): Tensor network state methods for non-Markovian open quantum system dynamics

Tuesday, 23 April, 2024

09:15-09:55 **Reinhard Noack** (Marburg): Mode Transformation DMRG for Two-Dimensional Electron Systems

10:05-10:45 **Philippe Corboz** (Amsterdam): iPEPS for layered systems and incommensurate spin spiral phases

10:55-11:20 Coffee break

11:20-11:40 **Albert Gasull** (MPI Quantum Optics): An exact representation of a gapped chiral phase with field theoretical PEPS

11:45-12:05 **Tatiana Vovk** (IQOQI Vienna): Minimising entanglement in tensor-network quantum trajectories

12:10-14:10 Lunch break

14:15-14:55 **Natalia Chepiga** (Delft): Resilient infinite randomness for a disordered Majorana chain

15:05-15:25 **Lexin Ding** (LMU): Quantum Information-Assisted Complete Active Space Optimization

15:30-16:00 Coffee break

16:00-17:30 **Poster session**

Wednesday, 24 April, 2024

09:15-09:55 **Mi-Song Dupuy** (Sorbonne): Abelisation of the SU(2) symmetry for QC-DMRG

10:05-10:45 **André Uschmajew** (Augsburg): Dynamical low-rank tensor approximations to high-dimensional parabolic problems

10:55-11:20 Coffee break

11:20-12:00 **Martin Ganahl** (SandboxAQ): Tensor processing units and the density matrix renormalization group

12:10-12:30 **Mathias Oster** (RWTH Aachen): Solving High-Dimensional Optimal Control Problems with Empirical Tensor Train Approximation

12:35-14:10 Lunch break

14:15-14:55 **Roman Ellerbrock** (TerraQuantumAG): Advances in Tensor Network-Induced Sparse Grid Methods for Chemical Applications

15:05-15:25 **Riley Preston** (Freiburg): Application of hierarchical equations of motion in the tensor train formulation to the scattering of molecules from metal surfaces

15:30-15:50 **Maximilian Dorfner** (TUM): Quantum Dynamics for Coupled Electron - Vibrational Systems with Matrix Product States

15:55-16:20 Coffee break

Wednesday, 24 April, 2024 ….*continued*

16:20-17:00 **Frank Pollmann** (TUM): Isometric Tensor Networks: Efficient numerical simulations and exact representation of quantum states

19:30 - open end Workshop dinner & scientific exchange in the **Augustiner Bräustuben**, central Munich

Thursday, 25 April, 2024

09:15-09:55 **Christian Schilling** (LMU): Quantum Information Perspective on the Ground State Problem: What is Electron Correlation?

10:05-10:45 **Christian Mendl** (TUM): Riemannian quantum circuit optimization and optimal linear contraction ordering of tree tensor networks

10:55-11:20 Coffee break

11:20-11:40 **Wei Tang** (Ghent): Matrix product state fixed points of non-Hermitian transfer matrices

11:45-12:05 **Sirui Lu** (MPI Quantum Optics): Variational Neural and Tensor Network Approximations of Thermal States

12:15-12:55 **Jens Eisert** (FU Berlin): Some new ideas on tensor networks to capture entanglement in quantum many-body systems

13:05 Closing words

Scientific organisers:
Thomas Barthel (Duke)
Gero Friesecke (TUM)
Henrik Larsson (University of California, Merced)
Örs Legeza (TUM-IAS and Wigner Research Centre for Physics, Budapest)
Local organisers:
Diane Clayton-Winter, Gero Friesecke, Örs Legeza